

THE RELATIONSHIP BETWEEN
RESIDENTIAL DENSITY AND HUMAN ACTIVITY

by

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CONTENTS

CHAPTER ONE

1.	INTRODUCTION	1
2.	OBJECTIVE OF STUDY	2
3.	RATIONALE	4
4.	LITERATURE REVIEW	5
5.	OPERATIONAL DEFINITION	12

CHAPTER TWO
RESEARCH DESIGN

1.	SITE SELECTION	17
2.	THE SAMPLE	23
3.	INSTRUMENT AND DATA GATHERING TECHNIQUE	23

CHAPTER THREE
RESEARCH FINDINGS

1.	SAMPLE PROFILE	25
2.	OBJECTIVE DENSITY VS PERCEIVED DENSITY	29
3.	OBJECTIVE AND PERCEIVED DENSITY VS HUMAN ACTIVITIES	32
4.	DEMOGRAPHIC CHARACTERISTICS, PERCEIVED DENSITY AND HUMAN ACTIVITIES	37

CHAPTER FOUR
CONCLUSIONS

1.	DISCUSSION	43
2.	LIMITATIONS	50
3.	IMPLICATIONS FOR FUTURE RESEARCH	51

APPENDIX A	RESEARCH INSTRUMENT	53
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APPENDIX B	ACTIVITY CODES	57
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APPENDIX C	MISCELLANEOUS STATISTICS	64
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BIBLIOGRAPHY	69
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LIST OF TABLES

TABLE 1:	Frequency and Percent Distribution Of Individual Characteristics For Three Sites.	.26
TABLE 2:	Analysis of Variance For Perception of Density Among Three Sites	.29
TABLE 3:	Test of Independence On Three Sites VS Three Perception Groups - Low, Medium, High	.31
TABLE 4:	Analysis of Variance For Question 5 About Street Widths In Different Sites.	.32
TABLE 5:	Analysis of Variance For Question 6 About Open Space In Different Sites	.32
TABLE 6:	Frequency Distribution, Mean, and Standard Deviation For All Activities.	.35
TABLE 7:	Analysis of Variance For In-Home Socializing In Different Sites.	.34
TABLE 8:	Analysis of Variance For Duration With Family Members In Different Sites	.36
TABLE 9:	Analysis of Variance For Duration With Friends In Different Sites.	.36
TABLE 10:	Analysis of Variance For Perceived Density By Type of Home	.38
TABLE 11:	Post Test For All Activity Variables By Three Residential Sites.	.39
TABLE 12:	Analysis of Variance For Years Of Residence By Different Perception	.40
TABLE 13:	Analysis of Variance For Number Of Children By Different Perception	.40
TABLE 14:	The Frequency and Percent Distribution For Different Questions on Density.	.64
TABLE 15:	General Statistics For Different Questions of Density and Total Scores	.65
TABLE 16:	Correlation Analysis For All Activities	.65
TABLE 17:	Correlation Analysis For All Demographic Variables	.67

LIST OF TABLES (CON'T)

TABLE 18: Analysis of Variance For Number of Children In Three Sites	.68
TABLE 19: Analysis of Variance For Education In Three Sites.	.68
TABLE 20: Analysis of Variance For Years of Residence In Three Sites.	.68

LIST OF FIGURES

Figure 1: Man-Environment Interaction	2
Figure 2: Theoretical Relationship Between Physical System and Affective Responses.	.10
Figure 3: The Distribution of the Neighborhoods in the City of Manhattan, Kansas.	.18
Figure 4: The Low Density Site - Neighborhood Number 10	.19
Figure 5: The Medium Density Site - Neighborhood Number 4.	.20
Figure 6: The High Density Site - Neighborhood Number 9 (East of Campus Site).	.21

INTRODUCTION

The environment is inclusive not only of the physical components that are present, but also of social and individual behaviors that occur within it. In this sense, it is a process defined by its participants and the nature of their interactions. Physical components of environments are typically neutral, but social and individual behaviors vary drastically from one cultural context to another. This notion about the fixed and variable components of the environment can be seen with many different scopes; i.e. it can be argued that the physical characteristics are closely related to the patterns and forms of individual behaviors, and affect them to some extent. Also they can be seen as major factors in formulating the psychological perception of the individuals. On the other hand, the definition of the physical components is questionable because the characteristics of environments, their imageability, are highly related to the personal idiosyncracies which have a considerable amount of variation.

This discussion about the causal relationship between physical characteristics of the environment and affective responses of human behaviors can be further illustrated by the following diagrams:

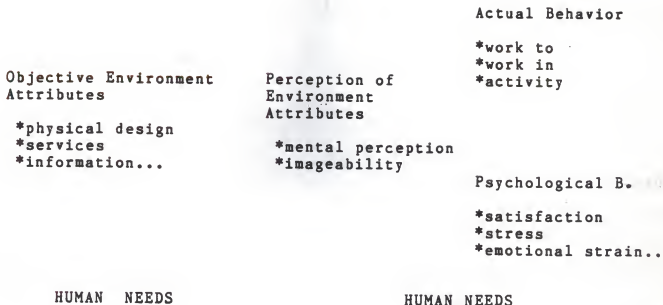


Figure 1
Man-Environment Interaction
An Elaborated Model

It should be clear from the foregoing discussion that the term "environment" embraces many points of view: "how we perceive and experience, in the psychological sense, our needs; how we modify and use it to serve our needs; and finally, how we accommodate our behavior over time in response to a setting.

OBJECTIVES OF STUDY

The main objective of this study is to examine the relationship between one of the physical components of the environment (residential density) and human behavior (daily activities). Another objective is to understand the perceived environment represented by perception of density.

The study of density and its effects has been an area of

active interest in psychology and behavioral science generally, also it has been an area of dominant interest in architecture and urban design. Jane Jacobs (1961), for instance, argued that higher density facilitated social supervision which in turn reduced crime and other forms of social deviation. Le Corbusier claimed that high density made civilization possible because environmental innovation rests on intense communication among people. Seon Dan (1978), suggested that higher population density may increase the use of shops, schools, and other services; that is, when more people live within a given radius, more services can be economically feasible within that radius.

Although there is considerable study of objective density (the physical measurement of density), researchers have been forced to examine how individuals perceive dense situations in order to more fully account for human behavior in environments varying in density. These studies have primarily examined the positive and the negative effects of physical and psychological aspects of density. One group of researchers documented that high density environments have significant effects on people's emotional strain and behavior (Mitchell 1971) and increase pathological incidence as well (Schmitt, 1966; Galle et al., 1972; Galle and Gove, 1979). On the other hand, another group of researchers indicated that high density may have positive as well as negative consequences (Verbrugge and Taylor, 1976); meanwhile, some studies showed no significant relationship between various density conditions and human behavior (Freedman et al., 1971).

This thesis will not test any of these positions but will examine, in an exploratory fashion, the relationship of perceived density to physical density measures and how both are related to everyday patterns of human activity.

RATIONAL

This thesis draws on the notion that a strong relationship exists between environment and behavior; and that the central to what degree and under what circumstances is behavior influenced by the environment. Barker (1978) states that the environment does not cause behavior but permits some behavioral patterns to take place, supports certain activities that take place and restricts others from taking place, thereby causing people to adapt their behavior to the setting. Behavior has long been described by psychologists as a goal-directed activity in which there is a unity of action, motive, perception and thought. This thesis focuses on human activity and its relationship to two dimensions of density. the human activity.

Perception is the process of obtaining the unique information about the environment through the different characteristics of individuals. In this thesis it will be necessary to assess perceived residential density as an additional measurement of the environment. In summary, this thesis will study the relationship between objective density, perceived density and their effects on everyday activities of residents.

It is anticipated that the findings from this research can be integrated with the growing body of information on the effects

of density and will be useful for planners and architects who must allocate and arrange the physical environment to support the activities of daily living. Also, it is hoped that results may give better understanding for those who are interested in the physical environment and how it is related to human activities. Finally, this research can be helpful for future researchers attempting to develop environment-behavior theories that account for the social and psychological effects of different levels of population density.

LITERATURE REVIEW

Density Versus Crowding

Researchers in various disciplines have been attempting to provide empirical support for the notion that high densities have detrimental effects on humans. While the negative effects of a dense environment on certain behaviors (e.g. Schmitt, 1966; Galle et al., 1972; Mitchell, 1971) have been widely reported, some positive effects have been found as well (e.g., Freedman et al., 1972; Booth, 1976; Loo, 1972). Some studies have discovered no significant relationship between various density conditions and human behavior. The inconsistency of these research results can be attributed, in part, to the methodological diversity of the studies and, also in part, to the divergence of conceptual and operational definitions of density and crowding. In fact, a great variety of meanings have been attached to the term "density" and "crowding" which prompts the question of what is meant specifically by density and at what point do density

dimension relate to the human experience of crowding.

Density

At its simplest, density refers to the number of social units (individuals, groups, dwellings, etc.) per unit of space. Early planners and sociologists' analyses used a variety of density measures (e.g., number of persons per acre or per room) without giving systematic attention to the different effects of these measures. It is only recently that there has been an increasing awareness that all operational definitions of density are not equal and that different patterns of population concentration may have strikingly different effects on people.

A recent approach in behavioral science investigates the differences of day-to-day interpersonal contacts within dwelling units. Schmitt (1966) distinguished between micro-level density, defined as persons per unit space within a residential unit, and macro-level density, defined as persons per unit space in a larger area. Similarly, Zlutnick and Altman (1972) make a distinction between inside dwelling-unit density and outside dwelling-unit density. Meanwhile, Galle et al. (1972) examines different levels of density in detail - persons per room, rooms per dwelling, dwellings per building, and buildings per acre. Booth (1976) further examines the different density effects on households and neighborhood levels.

Another approach involves the distinction between spatial and social densities. The former involves observing equal sized groups in spaces of varying size, while the latter involves observation of varying populations within equally sized spaces.

Even though each of these conditions may be designated "high density", the two situations, as revealed by psychological experiments, have very different social consequences and are perceived differently.

A perceptual element has been added to theorizing the nature of density by Rapoport (1975), who distinguishes between objective density and perceived density. Objective density refers to the change of space-size and population, while perceived density refers to the feeling of crowding.

Crowding

Most researchers agree that crowding deals with psychological, subjective states that typically have a stress component. Stokols (1972) reasons that such a feeling is associated with perception of too little physical and/or psychological space; others emphasize feelings of lost control over interpersonal interaction and undesirable or excessive contact with others (Altman, 1975; Milgram, 1970; Rapoport, 1975). For example, Altman claims that the experience of crowding results when one is unable to achieve desired levels of privacy, i.e., when one is exposed to more social interactions that he can control, Rapoport (1977) suggests that crowding stress occurs when one's perceptual or information processing capacity is overloaded by various stimuli in the environment.

Based on a biological-emotional-intellectual approach, Esser (1973) defines crowding with emphasis on the consideration of the richness of the environment, characteristics of the individual

and the socio-physical environment. These factors, along with the qualitative aspects of interaction, the actual proximity of others, and the increase in the number of social contacts can contribute to crowding.

In summary, we may say that crowding is a phenomenon of intensive and uncontrollable stimulation resulting from social and/or physical stress and of inadequate behavioral control over a spatially and/or socially constrained environment.

In differentiating between density and crowding, Proshansky et al. (1970) postulates that crowding can be defined as "a condition in which the number of people present are sufficiently large to reduce an individual's behavioral freedom". Stokols (1972) sharply distinguishes between density and crowding on the basis of physical- psychological differences. Density is regarded as a physical condition of limited space; crowding, on the other hand, is a psychological state, a subjective process.

Density is a necessary, though not sufficient condition for the feeling of being crowded. Crowding arises from conditions of high density only in the context of social and personal factors that sensitize one to the inconveniences of limited space (Stokols, 1972, 1976). People may also experience crowding when their goals are blocked by the mere presence of other people, even if there is sufficient space for all (Stokols, 1976). They may feel uncrowded with a group of friends, even when sharing a restricted amount of space (Freedman, 1975).

In summary, these studies substantiate the great complexity of the crowding concept as opposed to the simple concept of quantitative measurement of population and space which has been

used by many researchers. Current theory regarding the relationship between density and crowding states that density is an objective descriptor to be measured in terms of persons per spatial unit and that crowding is a subjective perception. High density, in and of itself, may not necessarily be detrimental to effective human functioning, and may not always lead to the experience of crowding; thus it is in no way equal to crowding.

Perception of Density

The lack of effects of density on human behavior suggests that how people perceive a high density situation may be an important determinant of their behavioral response (Verbrugge and Taylor, 1976; Schiarro, 1977). These findings are in agreement with present theoretical perspectives on density (Altman, 1975; Rapoport, 1975; Stokols, 1976). Given the potential importance of mediating perception, it seems worthwhile to explore its structure.

Perception has been defined as a mental complex or integration which has sensory experience as its core (Warran's 1934, Dictionary of Psychology). Also, it is the process of discriminating the qualitative or quantitative differences between objects or processes (Dictionary of Psychological Terms, 1954). In order to understand better the preceding definition, the diagram on the following page may be helpful.

The effects of density must be considered in terms of human responses, i.e., as subjective and perceived, principally in terms of the process of obtaining information. In the process of

evaluating that objective density, terms such as "low, high", "medium" should only be given to density when it is measured by the human responses. That means these terms are not absolute and represented by the same normative figures. In contrast, they are relative and represented by the subjective responses. For example, the term "high density" in Hong Kong and the United States are represented by very different figures (they are already evaluative terms). For comparison one must use figures which are true equivalents in terms of their effects, and they may, on the face of it, appear very different. That means, for valid comparison about "high density" in Hong Kong and the United States we may have to compare 700 to 100 persons/acre respectively (although these figures are arbitrary) as being the true equivalents. Therefore, it is suggested that density is best seen in terms of its perception (Rapoport, 1975). Finally, we can say that crowding is excessively high affective density, i.e., undesirable highly perceived density.

PHYSICAL SYSTEM

Density in people
per unit area

INPUT

INDIVIDUAL DIFFERENCES

Experience and sensory
modalities; hoped,
matched, or against
norms

PERCEIVED SYSTEM

Perception
of density

PROCESS

AFFECTIVE
RESPONSES

Passive
(isolated)
Active
(crowded)

OUTPUT

Figure 2*
Theoretical Relationship Between Physical
System and Affective Responses

*Adopted from "Redefinition of Density", Rapoport, 1975.

Human Activity

Much of the work on the perception of the built environment came from the need of architects and planners to understand both the behavior of individuals within urban structures and the way in which environments with different physical characteristics affect human behavior. In the above literature, the area of objective and perceived density has been reviewed briefly.

Now we need to discuss the human behavior within the built environment represented by how everyday activities for individuals are structured. Because environment is a structure of land uses and communication channels with physical social, and economic dimensions, all influencing and being influenced by human activities, it will be of great importance to study the structure and the form of these activities.

This thesis is concerned with the daily activities for the individuals. Chapin (1969) discussed the life system of an individual in terms of a flow of episodes, the flow from the hourly routine of a day, the daily routine of a week, the monthly routine of a year, and the yearly routine of a life-time. In addition to the flow of activities over time, the relative implied freedom with which a person engages in an activity is important. This notion can be represented by a continuum extending from obligatory activities at one end, to discretionary activities at the other end. Activities at the obligatory end of the continuum also tend to be activities of a more routine nature. For instance, physiologically sustaining activities such

as sleeping and eating, are the most obligatory. Some choice may sometimes be exercised as to where the activity occurs, and to a certain degree an individual can make changes in when he sleeps and eats; however, these generally occur in a day's sequence at roughly the same time. For instance, for each night's sleep, each breakfast, lunch, and dinner, roughly the same amount of time is used. Waking, going to school, shopping, and homemaking are another group of activities which fall into the obligatory category. Discretionary activities are the activities of special interest to individuals, such as visiting, socializing, relaxing around the house, or watching television. It is anticipated that the discretionary category will have the most variation among the groups of residents because they are more affected by individual motivations and values.

Finally, it is anticipated that a broad range of background variables are significantly associated with participation in selected classes of activity. Socioeconomic status, sex, age, educational background, duration of residence and physical characteristics of the living environment other than are some of the variables which are thought to be highly related to the activity patterns, and will be examined in this study.

OPERATIONAL DEFINITIONS

In order to measure the variation of the variables of the study, and to test the main relationships among these variables, an operational definition is necessary. Operational definitions to give meaningful empirical measurement to the variables in this study are given below:

Objective Density

As defined in previous research (Seon Dan, 1979), objective density includes the following:

1. NPD: Net Population Density; persons per net* residential land.
2. GBD: Gross Population Density; the number of persons per unit of gross* residential land.
3. NRD: Net Residential Density; is the number of dwellings per net residential land.
4. BC: Building Coverage; the net residential land covered by buildings in a percentage ratio.
5. FAR: Floor Area Ratio; total floor area divided by net residential land.
6. HD: Housing Density; number of persons per dwelling unit or per room.

This study considered only Net Population Density (NPD), Net Residential Density (NRD), and Housing Density (HD). These three measures were selected for this study because they could be related to the three relationships affecting the perception of density, i.e., Net Population Density represents the relationship between people and people, Housing Density represents the relationship between people and objects, and Net Residential Density represents the relationship between objects and objects.

*net means excluding the area of the streets, open spaces, services areas, etc. from the residential land area. *gross means the area of the streets, open spaces, services are included in the residential land area.

Perceived Density

An assumption in this study is that objective density does not have a direct effect on patterns of daily activities, but that activities are affected more by perceived density.

People respond differently to density in different situations, and this thesis studied how people perceive density in a residential setting, and how this perception affected human activities among setting inhabitants. There are three interactions affecting the perception of density (Rapoport, 1975): the relationship between people, people and objects, as well as objects and objects; all play a role in perception of density.

Thus, perceived density is viewed spatially in terms of; high degree of enclosure, intricacy of space, and communication channels. Secondly, perceived density considers the high activity levels and main uses of space. Finally, it involves socialinteraction, human sensory modalities, the mechanism for controlling interaction levels, the nature of groups, group homogeneity, rules for behavior.

A series of questions were developed to assess the perception of density along three dimensions: (1) perception of population density, (2) perception of density for people and objects, and (3) perception of the density of physical objects and their relationship to each other. These questions can be examined in Appendix A, page 53.

Human Activities

As stated earlier, the main purpose of this thesis is to explore the effects of different levels of objective and perceived density on daily human activities. Thus a representative sample of daily activities likely to vary with different levels of densities were selected from the work of Chapin (1969).

I. Obligatory Activities

1. In home obligatory (housework, eating meals, personal care, child centered activities, etc.)
2. Work related (everyday work, business, family properties, going to school, studying, etc.)
3. Shopping and personal services
4. Out-of- home obligatory (household errands, medical care, driving or transportation, etc.)

II. Discretionary Activities

5. Relaxation (resting, napping, lying down, etc.)
6. Arts, hobbies, and sports
7. Television and radio
8. In-home family activities (among the family members, talking together, discussing, etc.)
9. Reading (books, magazines, newspapers, etc., but not documents or reading for study purposes.)
10. In-home socializing (meeting friends, relatives, etc.)
11. Out-of-home discretionary (eating meals outside, going to the park, etc.)
12. Out-of-home family (entertaining, family outings, etc.)
13. Out-of-home socializing (visiting friends, relatives & social activities, etc.)

These activities are recorded by the subjects in the study in terms of their duration (how long did they take?), context (with whom did they happen?), and locale (where did they happen?).

CHAPTER 2

RESEARCH DESIGN

SITE SELECTION

with the help of U.S.census and Manhattan Planning Office data, three settings or neighborhoods in Manhattan, Kansas were choosen to represent three differen.objective densities. These were categorized as low, medium and high densities (see Figure 3).

1. Neighborhood No. 10 as (low objective density) as shown in Fig. 4 has the following attributes: the gross land area is 414.21 acres;the net residential land area is 196.75 acres; the population is 1124 persons,the net population density (NPD) is 6 persons/acre; the number of households is 340, the net residential density (NRD) is 1.72 dwelling/acre; the housing density (HD) is 3.31 person/dwelling. Additional characteristics for this neighborhood include mostly single family detached houses, with a considerable amount of open space (green area); there are no public buildings such as schools, fire stations, shops, etc.; there is one large park (Warner Park) inside the neighborhood. The physical design and landscape for the houses, in general, are considered to be well designed and well maintained.
2. Neighborhood No. 4 (medium density) is shown in Fig. 5 has the following characteristics: the gross land area is 160.32 acres; the net residential land area is 90.35

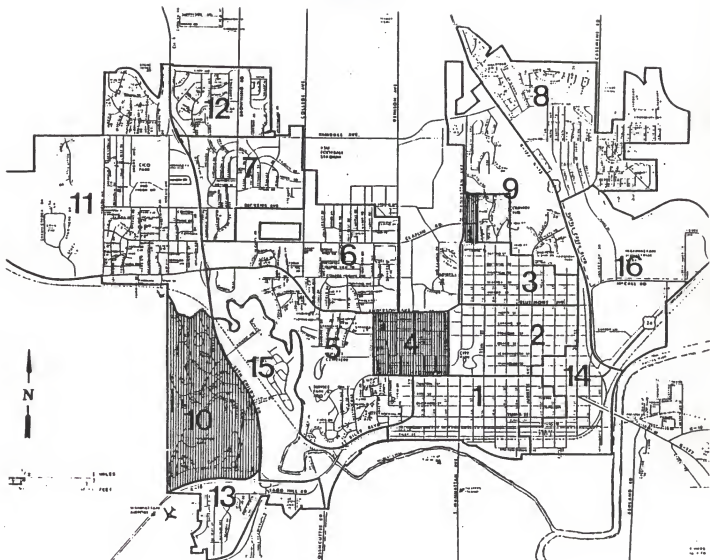


FIGURE 3

THE DISTRIBUTION OF THE NEIGHBORHOODS IN
THE CITY OF MANHATTAN, KANSAS

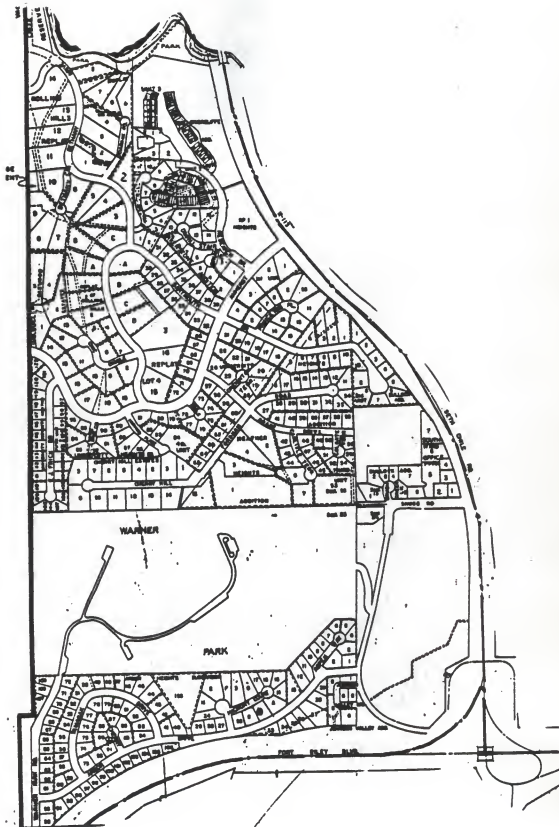


FIGURE 4

THE FIRST RESIDENTIAL SITE - LOW DENSITY
NEIGHBORHOOD NUMBER 10



FIGURE 5

THE SECOND RESIDENTIAL SITE - MEDIUM DENSITY
NEIGHBORHOOD NUMBER 4

acres; the total population is 2621 people; the net population density (NPD) is 29 persons/acre; the number of households are 833; the net residential density (NRD) is 9.21 dwelling/acre; the housing density (HD) is 2.34 persons/dwelling. This neighborhood is comprised of mostly mixed single family detached houses and apartment buildings; the amount of open spaces (green areas) for every house is relatively small; there is ~~some~~ one school, two gas stations, and a hotel. Streets are relatively narrow, especially for parking, and there is a public park (the main city park) adjacent to the neighborhood.

3. Neighborhood No. 9* (high density) as shown in Fig. 6 has the following attributes: The gross land area is 45.75 acres, the net residential land area is 31.83; the total population is 1104 persons; the net population density (NPD) is 34.6 persons/acre; the number of households are 320; the net residential density (NRD) is 10.05 dwelling/acre; the housing density (HD) is 2.35 persons/dwelling. The physical characteristics for this site include mostly two-story apartment buildings attached to each other and designed for recreational facilities such as swimming pools in

*In this neighborhood the east of campus site which has only apartment buildings only was chosen to be high density site (see the screened part of Fig. 5).

outside areas. Most of the apartment buildings have the same characteristic design. The streets are relatively wide, while the amount of open space (green areas) is fairly rare, there is no public buildings or public park inside or near this site.

THE SAMPLE

A list of all residents in all three neighborhoods was prepared with the aid of site plans and the telephone directory. A random sample of 270 of residents was selected from the three sites. From the first site a total of 135 subjects were selected, 30 people responded to a survey. In the second site, a total of 65 names were chosen, 34 people responded. In the third site a total of only 11 people responded, thus, to enlarge this small sample to be equivalent to the other two sites, residents were contacted directly and asked to participate in this research. This procedure yielded 32 responses, making a total sample from all three sites of $N=96$.

THE INSTRUMENT AND DATA GATHERING TECHNIQUE

A standardized questionnaire was used to gather data in three sections (see entire questionnaire in Appendix A). The first section assessed demographic variables (questions 1 to 10), the second section measured perceived density variable by asking six questions (questions 11 to 16), with a three response option format about how people see and evaluate the environment where they live. The third part of the questionnaire assessed the

daily patterns of activities for the residents. The respondents were asked to list, in chronological order, all the activities that they performed during the previous weekday. Also, respondents were asked to report the duration of each activity, with whom they did each activity, and where each activity took place. All activity data reported in this third section were later grouped into two categories, obligatory and discretionary activities (see Appendix B for activity codes).

The questionnaire was pretested on a sample of 10 people, 6 graduate students, 2 senior students, one working woman, and one professor. The pretest analysis led to making slight alterations in the instrument. The final form of the questionnaire was delivered by hand to the study participants in the three sites following a letter of announcement that briefly explained the purpose of the research. It took the respondents an average of 15 minutes to answer all the questions.

CHAPTER 3

RESEARCH FINDINGS

This research examined in an exploratory fashion, the relationships among objective density, perceived density, and daily activities. The demographic data will be discussed in this report first to understand better the general characteristics of the study participants. The extent to which these demographic characteristics affected the perceived density and human activity will then be reported.

SAMPLE PROFILE

A total of 96 subjects consented to be interviewed, comprising 28.3% of the sample. The lowest density site yielded an N=30 (20 males, 10 females); the medium density site yielded an N=34 (20 males, 14 females); while the highest density site produced an N=32 (14 males, 18 females).

About 40% of the total sample were between the ages of 20 and 29, 42% were between 30 to 50 years old, and 18% were older than 50 years old (see Table 1 for detailed description). Also, approximately 35% of the respondents were single while 58% were married. Most of the respondents in the low density site were married. Fifty-four percent of the people surveyed had one or more children. For educational background; 31% had graduate degrees and spent more than 16 years in formal education, 35% had college degrees and spent from 12 to 16 years in schooling, and

35% had either high school diplomas or did not have any diploma and spent less than 12 years in education. Finally, all respondents were white American, with the exception of two blacks; one from the Far-East.*

TABLE 1
Frequency and Percentage Distribution
of Individual Characteristics for Three Sites

	All Sites		Low Density Site		Medium Density Site		High Density Site	
	freq.	%	freq.	%	freq.	%	freq.	%
N responses	96	100	30	31.25	34	35.42	32	33.33
SEX								
1.Male	54	56.25	20	66.66	20	28.80	14	43.75
2.Female	42	43.75	10	33.33	14	41.10	18	56.25
AGE								
1.20-29	39	40.62	2	6.66	16	47.05	21	65.60
2.30-39	23	23.95	10	33.33	9	26.40	4	12.50
3.40-49	19	19.79	10	33.33	6	17.64	3	9.30
4.50-59	9	9.37	5	16.66	2	5.80	2	6.25
5.over 60	4	4.16	3	10.00	1	2.90	1	3.12
MARITAL STATUS								
1.Single	34	35.40	1	3.33	14	41.10	19	59.30
2.Married	56	58.33	28	93.33	20	58.80	8	25.00
3.Divorced	5	5.21	1	3.33	0	00.00	4	12.50
4.Widow/er	1	1.04	0	00.00	0	00.00	1	3.13

*This observation about subjects' race was recorded by the interviewer and not a part from the questionnaire.

TABLE 1 (CON'T)

	All Sites		Low Density Site		Medium Density Site		High Density Site	
	freq.	%	freq.	%	freq.	%	freq.	%
N CHILDREN								
0.No child	44	45.80	3	10.00	17	50.00	24	75.00
1 Child	7	7.20	4	13.33	1	2.94	2	6.25
2 Child	26	27.08	13	43.33	9	26.40	4	12.50
3 Child	12	12.50	6	20.00	5	14.70	1	3.13
4 or over	7	7.20	4	13.33	2	5.80	1	3.13
EDUCATION								
1.< 8 years	5	5.21	0	00.00	3	8.83	2	6.25
2.8-12	10	10.41	1	3.33	5	14.71	4	12.50
3.13-16	31	32.92	8	26.67	9	26.47	14	43.75
4.over 16	50	52.08	21	70.00	17	50.00	12	37.50
DEGREE RECEIVED								
1.None	4	4.17	0	00.00	1	2.94	3	9.37
2.High Sch.	28	29.17	4	13.33	8	23.52	16	50.00
3.College	34	35.41	12	40.00	14	41.17	8	25.62
4.Gr.Degree	30	31.25	14	46.67	11	32.35	5	15.62
TYPE OF HOME								
1.S.House	46	49.90	28	93.33	18	52.90	0	00.00
2.Duplex	9	9.37	0	00.00	4	11.70	5	15.62
3.Appt.	36	37.50	0	00.00	10	29.40	26	81.20
4.Mobile	1	1.04	1	3.33	0	00.00	0	00.00
5.Town-H.	2	2.08	1	3.33	0	00.00	1	3.12
6.Other	2	2.08	0	00.00	2	5.88	0	00.00
YEARS OF RESIDENCY								
1.< 1 year	34	35.41	2	6.66	4	41.10	18	56.25
2.1-2 years	22	22.91	5	16.66	8	23.50	9	28.12
3.3-4 years	14	14.58	7	23.33	5	14.70	2	6.25
4. over 4	26	27.08	16	53.33	7	20.58	3	9.37

Results showed that 48% of residents were living in single family detached houses, most of them residing in the lower density site. Thirty-eight percent were living in apartment buildings, most of which were located in the medium and higher density sites.

The duration of residence in the current home differed between residents of lower and higher density sites. About 77% of the residents in the lower density site have lived more than three years in their current homes, while 56% in the higher density site spent less than one year there. This indicated that in the lower density site, people were less mobil than those transient residents living in the higher density site. Duration of residence, along with type of home, is considered an important factor affecting the perception of density.

In demographic terms, the sample can be divided broadly into two groups. The majority of people in the first group is between the ages of 30 and 50 years, married, has children, has graduate degrees, and has spent more than 16 years in formal education. Also, most of them have lived in single family detached houses for more than three years in the lower density site. The second group is between the ages of 20 and 29 years, single, have either a college degree or a high school diploma and has spent from 8 to 16 years in formal education. Finally, most of the second group has lived in apartment buildings for less than one year in the higher density site.

In summary, these differences were found to exist between residents in the higher density site, on the one hand, and medium

and lower density sites on the other hand. It is expected that these factors may affect to some extent, the perception of density as well as the patterns of daily activities.

OBJECTIVE DENSITY VS PERCEIVED DENSITY

Final scores on perceived density were calculated by adding the responses for the six questions in the second part of the questionnaire. The lower the score, the lower the perception of density. Scores ranged from 11 to 19 ($\bar{X}=14.1$, $SD=2.11$).

Some differences were tested between the three sites using analysis of variance. See Table 2 below. Significant differences were found between the three sites ($F=5.5$, $p<0.05$).

TABLE 2
Analysis of Variance for Perception
of Density Among Three Sites

Source of Variance	df	Mean Square	F	p
Between Groups	2	22.262	5.5	0.005
Within Groups	93	4.047		
Total	95			

People who scored from 11 to 14 on perception (41 respondents) were grouped together in the low perception category; those who scored from 14 to 15 (33 respondents) were grouped in the medium perception category; and finally, those who scored from 16 to 19 (22 respondents) were grouped in the high perception category. These three hypothetical categories were

related to the three measures of net population density. The lower density site was given the number 1; the medium density site was given the number 2; and the higher density site was given the number 3. A chi-square test revealed that perception categories were significantly related to objective density in three sites, where chi-square value = 15.83 and $p < 0.01$, (see Table 3 on the following page). This finding, along with the analysis of variance finding, indicates that perceived density is closely related to objective density.

A detailed analysis* of the perception of density structure was conducted. To allocate the variation among the three relationships that defined perception, analysis of variance for the six questions in reference to the three sites were performed separately. Results revealed that question 5 (street widths) and question 6 (the amount of space) had the most variation among the three sites (see Table 4, 5).

*The frequency and percent distribution for the different questions among three sites appears in Table 13 Appendix C. Also, the general statistics for different questions and total score of perception appears in Appendix C, Table 14.

TABLE 3

Test of Independence on Three Sites
VS Three Perception Groups - Low, Medium, High

SITES	PERCEPTION GROUPS			
FREQUENCY EXPECTED CELL CH12 PERCENT ROW PCT COL PCT	GR1	GR2	GR3	TOTAL
Low Density Site 1	16 8.1 7.6 16.67 53.33 61.54	10 15.0 1.7 10.42 33.33 20.83	4 6.9 1.2 4.17 13.33 18.18	30 31.25
Medium Density Site 2	4 9.2 2.9 4.17 11.76 15.38	21 17.0 0.9 21.88 61.76 43.75	9 7.8 0.2 9.38 26.47 40.91	34 35.42
High Density Site 3	6 8.7 0.8 6.25 18.75 23.08	17 16.0 0.1 17.71 53.13 35.42	9 7.3 0.4 9.38 28.13 40.91	32 33.31
TOTAL	26 27.08	48 50.00	22 22.92	96 100.00

* CHI-SQUARE = 5.838

DF = 4

PROB = 0.0032

Where; GR1 = low perception group; GR2 = medium perception group;
GR3 = high perception group.

TABLE 4

Analysis of Variance for
Question 5 About Street Widths
In Different Sites

Source of Variance	df	Mean Square	f	p
Between Groups	2	2.2004	12.61	0.0001
Within Groups	93	0.1744		
Total	95			

TABLE 5

Analysis of Variance for
Question 6 About Open Space
In Different Sites

Source of Variance	df	Mean Square	f	p
Between Groups	2	1.228	5.95	0.003
Within Groups	93	0.204		
Total	95			

OBJECTIVE AND PERCEIVED DENSITY VS HUMAN ACTIVITIES

As defined earlier, 13 different daily activities were assessed and later categorized into two groups: GR1=obligatory activities and GR2=discretionary activities. The duration for every activity, was determined using a quarter of an hour (15 minutes) as a unit of measurement. In addition, the amount of time that respondents spent with others during the day was

measured with the same unit of measurement (15 minutes). For example: DUR1 is the amount of time that every respondent spent alone during the day; DUR2 is the amount of time spent with family members; DUR3 is the amount of time spent with relatives; DUR4 is the amount of time spent with friends; and DUR5 is the amount of time spent with others. Finally, the same unit of measurement (15 minutes) was used to measure the amount of time that respondents spent during the day in different locales. For example: WH1 is the amount of time that every respondent spent inside his home; WH2 is the amount of time spent inside other buildings; WH3 is the amount of time spent in the neighborhood; WH4 is the amount of time spent on the streets; and WH5 is the amount of time spent outside the city of Manhattan, Kansas.

The whole sample reported that they spend an average of 9.5 hours (38 quarter units) during the day doing obligatory activities (GR1) and an average of 6.5 hours (26 quarter units) doing discretionary activities. The longest obligatory activities were: work related activities, i.e. paid work, business, family properties, etc., which consumed an average of 5.75 hours (23 quarter units); and in-home obligatory activities, i.e. housework, personal care, child centered activities, etc., which consumed an average of 2.5 hours (10 quarter units). Shopping and personal services (ACT 3) had the shortest time reported among obligatory activities. On the other hand, the longest discretionary activity was watching TV (ACT 7) which consumed an average of 1.5 hours (6 quarter units). The shortest time reported among all discretionary activities was resting and relaxing (ACT 5) which consumed an average of 1/2 hour (2 quarter

units). Also, people reported that they spend an average of 4.15 hours (21 quarter units) during the day by themselves and that they spent an average of 7.25 hours (29 quarter units) inside their homes* (see Table 6 on the following page).

An analysis of variance by each activity among three neighborhoods was conducted. Results revealed that the duration of in-home socializing (ACT 10), i.e.: friends visiting, telephone calls, cocktails, etc., has a significant difference among the three sites where f value = 3.24 and $p < 0.01$ (see Table 7). People living in higher and medium density sites tended to socialize inside their homes more than people living in lower density sites.

TABLE 7
Analysis of Variance For In-Home
Socializing (Act 10) By Different Sites

Source of Variance	df	Mean Square	f	p
Between Groups	2	77.89	3.24	0.04
Within Groups	93	24.04		
Total	95			

* The regular sleeping time by night was not measured which makes the measured active day 15-16 hours.

TABLE 6

Frequency Distribution, Mean,
And Standard Deviation For All Activities
By Objective Density

ACTIVITIES	ALL SITES			LOW DENSITY SITE			MEDIUM DENSITY SITE			HIGH DENSITY SITE		
	FQ	MEAN	ST.D	FQ	MEAN	ST.D	FQ	MEAN	ST.D	FQ	MEAN	ST.D
ACT1	95	10.3	07.0	30	12.0	07.7	33	10.5	07.0	32	8.40	06.3
ACT2	76	23.3	15.8	21	21.4	16.2	28	23.4	16.4	27	25.0	15.4
ACT3	18	00.8	01.9	06	00.8	02.0	04	00.5	01.6	08	01.1	02.2
ACT4	66	03.2	04.4	22	04.2	05.7	25	02.6	02.8	21	02.8	04.4
ACT5	31	01.7	03.4	08	01.7	04.1	15	02.1	03.6	08	01.2	02.4
ACT6	36	02.8	04.3	11	02.6	04.5	09	02.0	04.0	16	03.7	04.5
ACT7	60	06.1	07.0	21	05.6	05.3	23	07.0	07.7	16	05.7	07.7
ACT8	29	01.9	03.9	14	03.0	04.9	08	01.4	03.5	07	0.13	03.0
ACT9	40	02.7	04.5	20	03.3	03.0	07	01.3	03.2	13	03.6	06.2
ACT10	37	03.0	05.0	05	01.1	03.8	14	03.6	05.6	18	04.1	05.1
ACT11	25	02.0	05.3	06	02.6	07.7	13	02.4	04.2	06	01.1	02.9
ACT12	21	02.1	05.4	09	02.3	04.6	10	03.0	05.7	02	01.1	05.6
ACT13	35	03.3	06.2	10	03.6	08.5	11	03.3	05.6	14	02.9	04.2
DUR1	95	20.5	15.2	30	17.3	11.3	33	21.5	15.9	32	22.5	17.4
DUR2	60	15.0	16.3	29	23.3	15.7	19	14.9	16.5	12	07.2	12.6
DUR3	04	00.2	00.8	00	00.0	00.0	01	00.1	00.5	03	00.4	01.3
DUR4	48	11.3	14.8	09	04.2	09.1	18	13.4	14.7	21	15.8	17.0
DUR5	54	13.6	15.6	18	16.2	17.1	18	10.8	12.2	18	14.3	17.4
WH1	93	28.7	14.9	29	27.4	14.6	32	29.1	15.8	32	30.3	14.5
WH2	75	18.5	15.8	19	17.3	17.0	29	18.0	15.5	27	20.3	15.3
WH3	32	03.0	05.8	07	01.8	04.0	14	04.0	07.4	11	03.0	05.1
WH4	62	03.0	04.6	19	04.2	07.0	21	02.1	02.4	22	02.6	02.9
WH5	26	06.8	14.2	10	12.4	19.8	08	03.5	07.5	08	05.0	12.2
GR1	96	37.6	12.6	30	38.4	13.7	34	37.0	13.5	32	37.3	10.7
GR2	95	25.5	11.4	30	25.8	12.8	34	26.0	10.4	31	24.7	11.4

* Where ACT1 to ACT13 all coded activities, DUR1 to DUR5 the duration for being with others, WH1 and WH5 the duration for being in different places, and GR1 and GR2 the two groups of obligatory and discretionary activities.

* The unit of measurement is the quarter of an hour (15 minutes).

Also results showed a significant difference for the duration of being with family members (DUR2) and the duration of being with friends (DUR4) among three sites (see Tables 8 & 9). In lower objective density site people spent more time with their family members and less time with friends than those living in higher and medium density sites.

TABLE 8
Analysis of Variance For
Duration with Family Members In Different Sites

Source of Variance	df	Mean Square	f	p
Between Groups	2	2010.09	8.87	0.0003
Within Groups	93	226.63		
Total	95			

TABLE 9
Analysis of Variance For Duration
With Friends In Different Sites

Source of Variance	df	Mean Square	f	p
Between Groups	2	1157.71	5.8	0.004
Within Groups	93	199.50		
Total	95			

Analysis for the groups of obligatory and discretionary activities showed no significant difference among the three sites. Also, all the results from the different statistical tests for the relationship between perception of density and everyday activities were insignificant. Thus the null hypothesis of no relationship between perception and activity cannot be rejected in this research. However, a series of analyses to test the relationships between activity variables and demographic characteristics will be discussed in the next section.

DEMOGRAPHIC CHARACTERISTICS, PERCEIVED DENSITY AND HUMAN ACTIVITY

The intention of this part of the analysis was to determine the extent to which the perception of density and the pattern of human activities show demographic differences. Among all group characteristics, only age, number of children, type of home, and years of residence in the current dwelling showed any direct relationship to perceived density. On the other hand, all demographic variables were found to have some significant relationship to activity data.

First, the relationship between the demographic variables and perceived density will be explored. Results revealed that there is a moderately positive correlation ($r=0.38$, $p<0.01$) between perception of density and type of home, where low value was given to single family detached houses and high value to apartment buildings. People living in apartment buildings perceived higher levels density than those living in single

family houses. Also, analysis of variance for perception of density among different types of homes (Table 10) were conducted. Results revealed that perception differs significantly among different types of homes.

TABLE 10
Analysis of Variance For
Perceived Density by Type of Home

Source of Variance	df	Mean Square	f	p
Between Groups	5	13.21	3.35	0.008
Within Groups	90	3.94		
Total	95			

For post test see table 11 in the following page. A negative correlation ($r=-0.22$, $p<0.02$) was found between years of residence and perceived density, that is, those that lived longer in their current homes perceived lower than more short-time residents. Also, an AVOVA showed that significant difference existed for perceived density and years of residency (Table 12), as well as number of children. (Table 13).

TABLE 11

Post Test For All Activity Variables
By Three Residential Sites

	Low Density	Medium Density	High Density	F
	Mean N= 30	Mean N= 34	Mean N= 32	df=95
ACT 1	12.00 a	10.47 ab	8.44 b	n.s.
ACT 2	21.40 a	23.44 a	24.97 a	n.s.
ACT 3	0.83 a	0.50 a	1.09 a	n.s.
ACT 4	4.20 a	2.64 a	2.78 a	n.s.
ACT 5	1.73 a	2.12 a	1.21 a	n.s.
ACT 6	2.60 a	2.00 a	3.71 a	n.s.
ACT 7	5.56 a	7.02 a	5.68 a	n.s.
ACT 8	2.96 a	1.38 a	1.31 a	n.s.
ACT 9	3.26 ab	1.29 b	3.62 a	n.s.
ACT 10	1.13 b	3.61 a	4.09 a	n.s.
ACT 11	2.60 a	2.35 a	1.12 a	3.24*
ACT 12	2.30 a	2.91 a	1.06 a	n.s.
ACT 13	3.63 a	3.32 a	2.87 a	n.s.
DUR 1	17.33 a	21.52 a	22.46 a	n.s.
DUR 2	23.30 a	14.85 b	7.18 c	8.87**
DUR 3	0.00 a	0.08 a	0.37 a	n.s.
DUR 4	4.20 b	13.41 a	15.81 a	5.80**
DUR 5	16.16 a	10.79 a	14.28 a	n.s.
WH 1	27.43 a	29.05 a	30.31 a	n.s.
WH 2	17.33 a	17.97 a	20.28 a	n.s.
WH 3	1.83 a	4.03 a	4.95 a	n.s.
WH 4	4.20 a	2.14 a	2.59 a	n.s.
WH 5	12.36 a	5.00 b	3.47 a	3.69*
GR 1	38.43 a	37.05 a	37.28 a	n.s.
GR 2	25.80 a	26.02 a	24.71 a	n.s.
Perception	13.10 b	14.64 a	14.46 a	5.50**

* p < .05

n.s. not significant

** p < .01

a,b, mean grouping

ACT 1 - ACT 13 = duration of all coded activities

DUR 1 - DUR 5 = duration of being with others

WH 1 - WH 5 = duration in different locale

GR 1, GR 2 = duration of all obligatory and descretionary act.

TABLE 12

Analysis of Variance For Perceived
Density by Years of Residents
(Low, Medium, High)

Source of Variance	df	Mean Square	F	p
Between Groups	2	5.01	3.55	0.03
Within Groups	93	1.41		
Total	95			

TABLE 13

Analysis of Variance For Number
of Children By Different Perception
(Low, Medium, High)

Source of Variance	df	Mean Square	F	p
Between Groups	2	13.86	8.85	0.003
Within Groups	93	1.56		
Total	95			

Second, the relationship between demographic variables and everyday activities was then examined. A correlational analysis was conducted between age, number of children, education, type of home, and years of residence and the 13 activities (ACT 1 to ACT 13), including the duration of being with others and in different locations. The following correlations were found shown to be

significant: The remaining correlations were not significant.

1. Positive correlation ($r=0.21$, $p<0.04$) between in-home obligatory, i.e. housework, personal care, etc., and age, where older people spent more time doing this activity than younger ones.
2. Positive correlation ($r=0.29$, $p<0.004$) between out-of-home obligatory, i.e. business, medical care, transportation, etc., and education, where people who have higher educational background spent more time in this activity than those who have had less education.
3. Negative correlation ($r=-0.2$, $p<0.04$) between watching TV and educational background, where people who have higher education spent less time watching TV than those who have less formal education.
4. Positive correlation ($r=0.25$, $p<0.01$) between in-home family, i.e. family conversations, entertainment, birthdays, etc., and age, where older people spent more time in this activity than the younger ones.
5. Positive correlation ($r=0.21$, $p<0.04$) between reading and age, where older people reported that they spend more time reading than younger people who reported less time.
6. Negative correlation ($r=-0.26$, $p<0.01$) between in-home socializing, e.g., friends visiting, cocktails, coffees, teas, parties, etc., and age, where older people reported less time was spent than younger people. Also, there was a negative correlation ($r=-0.032$, $p<0.001$) between in-home socializing and number of children.
7. Positive correlations between the duration of being with family members and age, education, and number of children, where $r=0.35$, 0.27 , 0.5 respectively and $p<0.01$.
8. Negative correlations between the duration of being with friends and age, number of children, education, and years of residence, where $r=-0.52$, -0.55 , -0.35 , -0.36 respectively and $p<0.001$.

No significant relationship were found between the groups of obligatory and discretionary activities and demographic variables. The interactions among activities and demographic characteristics are shown in Tables 15 and 16, Appendix C.

There have been some significant results on analysis of

variance tests for activity variables by different characteristic groups. These results are as follows:

1. In-home obligatory: differs significantly by; sex ($f=5.71$, $p<0.01$); marital status ($f=7.6$, $p<0.001$); number of children ($f=5.7$, $p<0.01$); and type of home ($f=3.6$, $p<0.01$).
2. Work related activity: differs significantly by; marital status ($f=2.9$, $p<0.05$); and type of home ($f=3.1$, $p<0.01$).
3. Shopping and personal care services: differs significantly by; age ($f=2.5$, $p<0.05$); and marital status ($f=2.9$, $p<0.05$).
4. Out-of-home obligatory: differs significantly only by educational background ($f=2.9$, $p<0.05$).
5. In-home family: differs significantly by; age ($f=3.1$, $p<0.01$); and number of children ($f=5.6$, $p<0.05$).
6. Reading: differs significantly only by marital status ($f=4.5$, $p<0.01$).
7. In-home socializing: differs significantly by; sex ($f=4.9$, $p<0.01$); number of children ($f=10.9$, $p<0.001$); and type of home ($f=2.8$, $p<0.005$).
8. Out-of-home family: differs significantly by; marital status ($f=3.1$, $p<0.05$); and type of home ($f=6.4$, $p<0.001$).
9. The duration of being with family members: differs significantly by; age ($f=4.6$, $p<0.001$), marital status ($f=27.9$, $p<0.001$); number of children ($f=45.9$, $p<0.001$); and type of home ($f=7.45$, $p<0.001$).
10. The duration of being with friends: differs significantly by; age ($f=12.6$, $p<0.001$); marital status ($f=31.9$, $p<0.001$); number of children ($f=47.4$, $p<0.001$); educational background ($f=4.3$, $p<0.01$); and type of home ($f=3.6$, $p<0.01$).
11. The duration of being inside the home: differs significantly only by sex ($f=7.4$, $p<0.01$).
12. The duration of being the neighborhood: differs significantly by; age ($f=3.8$, $p<0.001$); and years of residence ($f=3.0$, $p<0.05$).
13. All obligatory activities (GR1): differs significantly only by age ($f=2.5$, $p<0.05$).
14. All discretionary activities (GR2): differs significantly only by age ($f=2.7$, $p<0.01$).

CHAPTER 4

CONCLUSION

DISCUSSION

The most significant finding that emerged from this research was that measures of perception of density are positively related to objective density measures. This finding contradicts the argument that the overall density of a city interferes, to some extent, with the people's perception, particularly in cities having low densities, like Manhattan, Kansas, since they do not allow for enough variations in perception. This contextual approach can be true in comparing different cities, but it is false in comparing different settings within the same city. This finding supports the argument raised by Rapoport (1975) that terms such as "low", "medium" or "high" densities do not have a consistent meaning among different environments, and they can be meaningful only in describing perceived density situation.

The variation in perception that was found to exist among the three different sites can be attributed to either demographic characteristics or to the conceptual definition of perception. Both attributes should be carefully examined to understand better the structure of perceived density as well as its variation. First the demographic characteristics will be discussed, then the conceptual definition of perception will be explored.

Although three groups from three different sites were surveyed, results revealed that only two groups differed significantly on demographic characteristics. The first group is

middle age, married professionals (30-50 years old), who have spent more than 16 years in formal education (most of them have graduate degrees). Most of these people are living in single family detached houses, with front and backyards, have an average of two children living with them, and have been in the low density neighborhood for more than three years. The second group is mostly young students or professionals (average age from 20-29 years) have spent from 8-15 years in formal education, or were still going to school. Most are living in apartment buildings in the high density site, and have been in their current homes for only one or two years.

Test for the effects of selected demographic variables on different levels of perceived density, disregarding objective density, those with low scores (11-14) were placed in a low perceived density score (N=41), those with medium scores (15-16) made up the second group (N=33), and people having high scores (16-19), a third group (N=22). Significant variation was observed for only three variables: number of children, years of residence, and type of home. Residents who have children living with them perceived a higher level of density than those who did not. This fact can be attributed to either the residents fear of traffic while their children were playing, or to their dissatisfaction with the amount of space available inside their homes and they would prefer to move to another home where more space was provided to accommodate their childrens needs.*

*These issues were raised by respondents in informal discussions after they completed the survey.

Also, residents who lived in their current homes for longer time periods perceived a lower density than those who spent shorter time periods. It appears that those who chose the community for permanent residence - to work in and raise their children - preferred to settle in less dense suburbs with more greenery and privacy. On the other hand, those who were more transient residents going to school or temporary business opportunities - had to be nearer to the downtown or to Kansas State University. Consequently, they were dissatisfied with the dense organization of houses and attached buildings.

Finally, density was perceived to be higher by those residing in apartment buildings than by people in single family detached houses. However, it is difficult to untangle the effects of these variables: residents with longer periods of residence, are also those who inhabit single family houses, while those with shorter periods of residence inhabit the apartment buildings.

Thus, except for these three variables (number of children, years of residence, and type of home) perception of density has not been statistically related to any other demographic variables.

We will now examine how the conceptual definition of perceived density might in itself account for variations in responses. As stated earlier, perceived density can be defined in terms of: a relationship between people and people, a relationship between people and objects, a relationship between objects and objects. Several questions were developed to assess

these relationships. Several relationships emerged from the analysis of these questions. The space organization dimension (the relation between objects and objects) showed a significant variation among respondents, specifically question 5, about street widths, and question 6, about the amount of open space. Most people living in the medium and high density sites evaluated the street widths as narrow and the amount of open space as not enough, while most of the people in the low density site were satisfied with these two factors. On the other hand, the space availability factor was constant among all three sites, and most people evaluated the area inside their homes either as just about right or too small.

The number of people factor (the relationship between people and people) was constant among the three sites, where only a few people preferred to live amongst more people than were in their existing situations. From the forgoing analyses it seems ^{safe} should that the organization of the physical elements in the environment did play a role in how people perceived density.

The other area of interest in this research was the human activity and how it related to both objective and perceived densities. All analyses used to test this assumption were insignificant thus, no relationship between activities and perception were found. Meanwhile, some variation among different groups of activities in the three sites was observed.

To understand the structure of the activity patterns, it will be helpful to have an overview description before moving to any detailed discussion. It was proposed to examine three different measures of activity: the duration of the activity

performed during a day, the duration that respondents spent with others, and the duration that respondents spent in different places. It was assumed that three groups of independent variables would affect these three measures of activities: the physical components of the environment represented by objective density, neighborhood characteristics and the type of home; demographic characteristics such as sex, age, marital status, education and number of children; and the perception of environment in terms of the three relationships discussed earlier.

Overall physical components had some effect on in-home socializing, e.g., visiting of friends, cocktail and teas parties; as well as on out of home family activities, e.g., family outings, picnics, sight seeing. People in the low density site spent more time in these activities than those in the high density site. This variation might be explained by the physical characteristics between these two sites. For instance, it can be assumed that the proximity of a public park (Parker Park), together with the low flow of traffic in the low density site encouraged families to go out with their children more. Also, the larger amount of space available in single family dwellings might make it easier for residents to invite friends or relatives over for visits, parties, dinners or cocktails.

Demographic characteristics had a considerable influence on human due to their role in shaping man's behavior and psychological responses. This research has lent validity to this theoretical assumption. For example, variables such as: sex,

age, marital status, number of children, affected most of the activities that have been measured. Females showed more likelihood than males of spending more time inside the home performing obligatory activities, in-home socializing, as well as just spending more time by themselves (alone). Both greater family responsibilities and a larger number in the household were associated with an increase in the time spent in the home performing obligatory and family activities as well out-of-home activity. Marital status and number of children were also associated with a reduction in the amount of time spent with friends. Mature and educated individuals were showed to spend less time watching television and more time reading. Younger people who were mostly students that usually spend a great amount of time studying and working, devoted more time to work related activity than older people. However, age went one step further by being inversely related to obligatory activities and proportionately related to discretionary activities. This was hardly surprising, given that the amount of studying and working time was associated with being a student and with being family oriented.

In general, people declined to report that they spent more time performing obligatory activities than discretionary activities. What was surprising was that resting and relaxing during the day was the least reported among all activities, and the average duration was 20 minutes. Since most people should rest or relax during the day, we can hypothesize that they did not choose to report it in the questionnaire. Also, respondents were likely not to talk about the kind of activities that were

closely related to their personality or that might display their idiosyncrasies.

In summary, this thesis explored relationships among objective density, perception of density, and patterns of daily activities. The study showed that among the three sites, people's perceptions of density were more related to the physical measurement of density than to demographic characteristics. Daily activities were more influenced by demographic variables than by physical density variable. The relationship between perception of density and activities was insignificant.

The findings from this study can be helpful to planners and architects in understanding how people with different characteristics may perceive and respond to various components of density in the built environment. It may give the designer a sound empirical basis for design decisions. For example, architects who must allocate and arrange the physical environment to support the activities of daily living should consider the kind of activities most likely to be needed among different groups and how long they take. Also, for neighborhood planners it will be important to understand that residential density is not just a number assigned to a certain area of land, but it is more related to human perception. For instance, in improving some design elements (open space, street widths, detached building, etc.) and raising the number of persons per area of land, we must consider the impact of people's perception. Of course more can be suggested about the specific application of the findings from this research to neighborhood planning, the

real power of this study lies in its potential to provide a general understanding of human behavior as related to the built environment. Also, the hypotheses generated by this study can be tested further by any researcher interested in the particular typical area.

LIMITATIONS

This study was limited in several ways. To begin with, the sample was small, only about 30 to 34 people were interviewed from every site. This small sample size resulted from the method of surveying, which required sending introductory letters, contacting subjects by telephone to make appointments, and finally, it took the respondents an average of 15-20 minutes to fill out the questionnaire.

Depending on the respondents' written description for the kind of activities, raises many questions regarding the research instrument. One question concerned whether people described their personal activities or the normal type of activities which are common among others? For exaple, it was observed that nobody mentioned going out for a drink, doing a certain kind of hobby that displays their idiosyncrasies, and few people mentioned that they take naps or resed during the day. A second question concens whether people recorded the real duration for a certain activity or did they record the perceived time? Also, many people combined activities in one period of time which required srting by the researcher. The last question is, how does the time of the year affect the pattern of daily activities? Because this research was conducted during the summer, perhaps people were on

vacation or involved in certain kinds of activities which are different from activities performed other times of the year.

Another limitation concerned the unequal economic status of subjects in the study. Those in the low density site had a higher socioeconomic level, than those in the medium and high density sites. This difference may account for some of variations on the dependent measures between groups.

Perhaps this study's most significant finding is that the research further demonstrates that an individual's perception of density can be predicted by techniques measuring the various interactions which formulate the perception structure. However, techniques measuring the activity patterns can be developed to overcome all the limitations discussed earlier.

IMPLICATIONS FOR FUTURE RESEARCH

Frequent assessment of density in an urban design domain should be conducted by architects and planners to determine improvements in design. Whether such assessments focus on neighborhoods, residential design, perception of environment or affective behavior they should provide useful information to architects and to those involved in environmental design and management decisions. The key is to design urban regions with human beings in mind. Decisions are made every day concerning those problems without benefit of information on man-environment interaction. The quality of these decisions could be improved by supplying better information dealing with how people perceive and work in their environment. The study's methods might be used in

integration with other methods to measure the effects of various components of physical environment on human perception and behavior. However, as with most if not all planning projects, many more facts were needed than could be obtained in one study. This study devoted more attention to perception and actual behavior than to affective responses and psychological reactions. Future research should specifically concentrate on four aspects: man-environment interaction, physical environment, perceived environment, actual behavior, and psychological responses. These should be investigated and interrelated in a systematic way.

Clearly, benefit would be obtained from a better understanding of people's activities in a residential environment, particularly with regard to their perception of this environment. Although more difficult to measure, vital comprehension must also be reached concerning individuals' satisfactions, needs, expectations, and adaptations.

Another issue requiring further investigation deals with how a person's past experience and background in other environments affects his perception and his activities in an environment new to him. For example, one respondent talked about his past experience in another city which had significantly fewer trees than Manhattan, and this increased his satisfaction to move to this city. How a researcher can separate past experience from present anticipation, is a question worthy of research.

APPENDIX A

QUESTIONNAIRE

Dear Resident:

My name is Yasser Mansour. I am a graduate student in the Department of Architecture at Kansas State University. For my Masters thesis I am studying the effects of residential densities on the every-day activities of Manhattan residents.

In order to accomplish this, I am asking you to help me with my study by filling out a short questionnaire that I would like to hand deliver to your home during the next few days. It should take no longer than 5 minutes to complete it. This information will help us learn about how we adjust our every-day activities due to the size and density of the area where we live. It will be of help to express your opinion about comforts and discomforts due to the density in your neighborhood. There should be no appreciable risk to you if you decide to help me.

Your participation is entirely voluntary and you may discontinue participation at any time. You may refuse to answer any of the questions that I might ask. The information you provide will be identified only by code number and your name will not be associated with it. The information will be confidential in this respect.

I will contact you by telephone to see when a good time will be to drop the questionnaire off at your home. If you have any questions concerning the study or your participation, please feel free to contact my major advisor, Prof. Paul Windley, Department of Architecture at Kansas State University, Manhattan, KS 66506. The number is 532-5953.

Now I would like to ask you some questions about yourself.
Please put a check mark in the appropriate box for each question.

1. Sex.
☐ Male ☐ Female
2. Age
☐ 20 - 29 ☐ 30 - 39
☐ 40 - 49 ☐ 50 - 59
☐ Over 60
3. Marital Status
☐ Single ☐ Married
☐ Divorced ☐ Separated
☐ Widow/Widower
4. Do you have children?
☐ Yes ☐ No
5. If yes, How many children do you have?
☐ 1 ☐ 2
☐ 3 ☐ More than 3
6. How many years did you spend in your education?
☐ Less than 8 years ☐ 8-12 years
☐ 13-16 years ☐ More than 16 years
7. Degree received:
☐ None ☐ High school Degree
☐ College degree ☐ Graduate Degree
8. What type of home do you currently live in?
☐ Single-family detached house
☐ Duplex ☐ Three or fourplex
☐ Apartment building ☐ Mobile home
☐ Town-house
☐ Other; _____
9. How long have you lived in your current home?
☐ less than a year ☐ 1 - 2 years
☐ 3 - 4 years ☐ more than 4 years
10. How many months do you usually spend in this home during the year?
☐ 1 - 3 months ☐ 4 - 7 months
☐ 8 - 11 months ☐ 12 months

Now I would like to ask you some questions about the area where you live.

11. Would you like to live around more or less people than you do now?
() More people () The same as now
() Less people
12. Would you describe the area where you live as:
() Isolated () Just right
() Slightly dense () Crowded
13. Think about the amount of space available in your home, is it:
() Too large () Just about right
() Not enough space
14. Do you think the other houses in your neighborhood are:
() Too far apart () About right
() Too close to each other
15. Are the streets in your neighborhood:
() Too wide () About right
() Too narrow
16. Do you see the amount of open space around your neighborhood as:
() Too open () About right
() Not closed

Now I would like to ask you about the things you did and the places you went yesterday. Take a moment to think about the things you did yesterday..... I am interested in all the things that happened to you yesterday, from the time you got up until you went to bed, especially the things you did with other people and the things you did outside your home.

Most people are not busy all day long. I expect that everyone has times when he is alone and does not do any thing special. I am interested in every thing you did such as:

- *Eating meals inside or outside your home
- *Taking care of things around the house or talking in telephone
- *Relaxing, resting or watching T.V.
- *Writing letters or meeting with friends.

Would you describe, in a few words, the kind of activities you did yesterday, the duration for each activity, with whom you did it, and where you did it.

Please write all the activities in the boxes available below. The first page is as an example of the kind of activities that I did yesterday. Now take a moment and think what kind of activities that you will be able to mention.

If you have any comments or observations about this questionnaire, please feel free to write it down in the space available below.

Thank you for your time and understanding.

APPENDIX B

ACTIVITY CODES*

OBLIGATORY ACTIVITIES

1. In-home obligatory activities.
2. Work related activities.
3. Shopping and personal services.
4. Out of home obligatory activities.

DISCRETIONARY ACTIVITIES

5. Relaxation and resting
6. Arts, hobbies and sports.
7. Television and radio.
8. In-home family activities.
9. Reading.
10. In-home socializing.
11. Out-home discretionary activities.
12. Out-home family.
13. Out-home socializing.

*Based on the work of Chapin 1969, "Human Activity Systems".

OBLIGATORY ACTIVITIES

1. IN-HOME OBLIGATORY ACTIVITIES

Includes all the following activities.

a) House Work

- * cleaning, arranging the house, decorating
- * laundry and ironing, helping in personal care

This does not include: doing the house work for paid income, (2).

- * maintenance of home, yard, or car
- * indoor painting, plastering, carpeting, wiring, fixing of household appliances (not for paid)
- * indoor plumbing, upkeep of heat and water supplies
- * out door painting or roofing
- * snow and ice removal
- * out door cleaning (side walks and garbage)
- * yard work and gardening (not hobby) cut grass, watering grass
- * routine car maintenance, washing and cleaning (not hobbies)
- * work around the house (if not specified)
- * pet care, feeding, washing, taking care if sick

This does not include: household business (2), any activity for hobby (6), or for paid (2)

b) Eating meals

- * eating meals and snacks at home or in yard
- * food preparation and cooking
- * cleaning up kitchen after or before meals
- * doing dishes

c) Personal Care

- * personal washing and dressing
- * all other private activities
- * getting up
- * get ready for..."at home"
- * medical care inside the home like; sick in bed, resting because feeling poorly

This does not include: visiting doctor, going to hospital, physical therapy (4)

d) Child Centered Activities (not for pay)

- * babysitting, feeding, putting small children to bed, bathing
- * helping with overseeing children's homework, practice, etc.

This does not include: conferences and visits, with school teachers, officials, counselors, etc. about one's child (4)

2. WORK RELATED ACTIVITIES

A) Paid work

- * include all paid employment, whether regular or sporadic, full or part time
- * paid babysitting, all work related tasks, trips, training, and overtime work
- * going to school, studying, meeting with professors, preparing for school and classes
- * all kind of readings related to school or to work

b) Business or Other Income Related Activities

- * analysis of stock market
- * running one's own business
- * seeing a broker
- * job hunting
- * interview, filling job applications
- * union activities, meetings and business, strikes and picketing if now employed
- * professional society or industry association activities, meeting, conventions, etc.

c) Family Properties

- * managing or maintaining own properties

3. SHOPPING AND PERSONAL SERVICES

a) Shopping for Goods and Services

- * convenience goods (food, sundries, drug, hardware, variety)
- * shopper goods (clothing, shoes, fabrics, etc.)
- * retail services; caterers, laundry, dry cleaning, tailoring, dressmaking, etc.

b) Personal Services

- * barber, beauty, pedicure, sauna, masseur, etc.

c) Repair Services

- * repair of automobiles, appliances and other consumer durables
- * contractors, home repair services
- * tailor, dressmaker for repair or mending

d) Window Shopping

This does not include: if subject is shopping for perscription or medical related commodity (4).

Can be concurrent; if subject is accompanied by friend or relative (13)

4. OUT OF HOME OBLIGATORY

a) Household Business, and Related Errands

- * routine use of governmental services and agencies; eg. post office, applying for taking examinations for permits or licenses
- * routine use of private services (bank, tickets offices, etc.)
- * reading or writing letters for household business, writing checks, paying bills, keeping records, etc.
- * telephoning for purpose of household business
- * paying hotel bills, checking into hotels, airports etc.
- * picking up or dropping off items, misc. errands

This does not include: all household business done inside the home (1), reading or writing mail to friends or relatives (10)

b) Professional Services

- * special services of lawyers, accountants, tax consultants, financial institutions, and brokers
- * househunting on one's own, looking at houses, property for sale
- * leasing out rental property or handling the sale of property if owned by one's for income

c) Medical Care (out of home)

- * inpatient at hospital, clinic, rest home, etc.
- * outpatient visits to hospital, clinics, doctor's offices, etc.
- * visiting psychologists and psychiatrists offices or clinics

- * visits to non-MD, non-DDS services, such as opticians, osteopaths, oculists, chiropractor, pharmacists for advise, and/or prescription.
- * including waiting time

d) Driving or Transportation

- * walking, driving, bicycling to destination
- * any kind of public transportation; bus, taxi, subway train, trolly
- * in car whether owned or driven by subject or other person
- * driving another person or relative somewhere
- * walking for physical therapy, and all the waiting time

This does not include: aimlessly walking or driving, driving or walking for pleasure (11), bicycling or walking for exercises (6), sightseeing (11)

5. RELAXATION AND RESTING

- * relaxing alone, smoking, sunbathing
- * sitting, rocking, daydreaming, thinking, planning (not household business)
- * going outdoor to relax in the evening
- * puttering around the house (not specific)
- * inappropriate behavior; eg. talks to self, crying, confused, etc.
- * walking around the home aimlessly
- * napping, lying down, resting (this can occur during the day or for sleepless time during the night)

This does not include: sitting and relaxing with relatives (8), friends (10), sleep at night (1)

6. ARTS, HOBBIES AND SPORTS

a) Arts

- * music, playing and practice
- * painting, sculpture, creative writing
- * chorus

This does not include: creative arts for regular income, or for potential sale (2)

b) Hobbies and Crafts

- * automobile (other than regular maintenance)
- * carpentry (other than normal house repair)
- * dressmaking and non-housework sewing
- * crochet work, needlepoint, weaving, making hook-rug knitting, etc.
- * gardening (other than normal yardwork)
- * potting plants indoors or outdoors
- * tending a garden, flowers, shrubbert, etc.
- * all other hobbies; crafts, collections, and handiwork

c) Sports and General Exercise

- * jogging, calisthics (not physical therapy)
- * walking for exercise (not with a relative, (12) or a friend (13))
- * bicycling for pleasure
- * golf, horseshoes, fishing, hunting, hiking, shuffleboard, water sports (pool or outdoors)
- * pick up sports (ping-pong, croquet)
- * bowling, shooting, billiards
- * all kinds of regular sports (football, volleyball, basketball, etc.)

This does not include: professional athletics, or part of being in school (2)

7. TELEVISION AND RADIO

- * viewing television, all content, includes movies, news or any TV show
- * listening to the radio, includes all programs, music and religious program

This does not include: listening to music while working, studying, driving, or with any other activity.

8. IN HOME FAMILY

- * among the family members
- * sitting, relaxing with family members in home
- * talking and gossiping (not household business)
- * playing games, cards inside the home
- * birthdays with family members This does not include: parties, weddings, receptions, bar mitzvahs, or dinner parties (10), childcare or overseeing child's study (10).

9. READING

- * all kind of reading not related to work or study
- * reading magazines, pamphlets, catalogues
- * reading newspapers, religious books

This does not include: reading mail from friends (10), household business mail (2), reading to child (1).

10. IN HOME SOCIALIZING - FRIENDS OR RELATIVES

- * relative or friend drops in
- * pre-arranging social calls in home
- * friends or relatives come in for visit
- * family birthdays, weddings (in home), bar mitzvahs, receptions
- * sympathy visits
- * telephone calls to relatives or friends
- * reading or writing letters to friends or relatives
- * cocktail, coffees, teas, brunches, luncheon parties

(ONLY IF ALL THESE ACTIVITIES REPORTED - IN HOME)

11. OUT OF HOME DISCRETIONARY

- * eating meals outside, going to parks, driving for sightseeing
- * watching sports - not as participant - such as; stadium (field) sports, arena and gymnasium sports, racetrack, horseracing, golf matches, tennis matches (outdoor, indoor)
- * watching a parade, amusement parks, rides and shooting galleries, fairs and carnivals, circuses
- * visiting museums, movie theaters, concerts

(Can be concurrent with windowshipping -3-)

12. OUT OF HOME FAMILY

These activities only when checked with family member(s).

- * family outings or drives
- * visits to memorials and monuments, historical sites, quaint parts of town
- * picnic and outings

This includes all the activities in code #11 if only checked with family members.

13. OUT OF HOME SOCIALIZING

- * visiting, talking to, seeing friends face to face - out of home
- * casual conversation (face to face) with friends, non-friends, relatives
- * private organizational parties and social life
- * banquet and dinners (unless coded as - in home)
- * dances, taverns or bars
- * church socials, dating

APPENDIX C

TABLE 14

The Frequency and Percent Distribution
For The Different Questions on Density

	All Sites		Low Density Site		Medium Density Site		High Density Site	
	freq	%	freq	%	freq	%	freq	%
Q1=amount of people								
1. More	9	9.37	1	3.33	2	5.80	6	18.70
2. Right	50	52.08	19	63.30	16	47.00	15	46.80
3. Less	36	37.50	9	30.00	16	47.00	11	34.40
Q2=site description								
1. Isolated	2	2.08	1	3.30	0	00.00	1	3.12
2. Right	57	59.40	22	73.30	17	50.00	18	56.25
3. S.Dense	29	29.10	5	16.60	14	41.10	9	28.12
4. Crowded	9	9.30	2	6.60	3	8.80	4	12.50
Q3=area inside home								
1. Large	7	7.29	3	10.00	3	8.80	1	3.12
2. Right	57	59.40	19	63.30	21	61.70	17	53.12
3. Small	32	33.30	8	28.60	10	29.40	14	43.75
Q4=other houses organization								
1. Apart	0	00.00	0	00.00	0	00.00	0	00.00
2. Right	51	53.10	21	70.00	16	47.00	14	43.70
3. Close	45	46.80	9	30.00	18	52.90	18	56.25
Q5=streets' widths								
1. Wide	0	00.00	0	00.00	0	00.00	0	00.00
2. Right	66	68.70	29	96.60	15	44.10	22	68.70
3. Narrow	30	31.25	1	3.30	19	55.90	10	31.25
Q6=open space								
1. Open	0	00.00	0	00.00	0	00.00	0	00.00
2. Right	63	65.60	26	86.60	22	64.70	15	46.80
3. Close	33	34.25	4	13.30	12	35.30	17	53.10

TABLE 15

General Statistics for Different
Questions of Perceived Density

	MEAN	SD.	MEAN	SD.	MEAN	SD.	MEAN	SD.
Q1.	2.26	0.67	2.20	0.66	2.41	0.61	2.61	0.72
Q2.	2.45	0.69	2.27	0.67	2.59	0.66	2.50	0.76
Q3.	2.26	0.58	2.17	0.59	2.20	0.59	2.40	0.56
Q4.	2.47	0.50	2.30	0.47	2.52	0.51	2.56	0.50
Q5.	2.31	0.47	2.03	0.18	2.56	0.50	2.31	0.47
Q6.	2.34	0.48	2.13	0.35	2.35	0.49	2.53	0.51
SCORE.	14.1	2.11	13.1	1.95	14.6	2.03	14.5	2.05

TABLE 16

Correlation Analysis for All Activities

	ACT1	ACT2	ACT3	ACT4	ACT5	ACT6	ACT7	ACT8	ACT9
ACT1	1.00 0.001								
ACT2	-0.5 0.001	1.00 0.001							
ACT3	-0.13 0.19	-3.4 0.001	1.00 0.001						
ACT4	-0.03 0.74	-0.27 0.01	-0.16 0.11	1.00 0.001					
ACT5	-0.03 0.74	-0.02 0.82	-0.01 0.91	-0.01 0.87	1.00 0.001				
ACT6	-0.01 0.87	-0.21 0.05	0.03 0.71	-0.12 0.23	-0.13 0.18	1.00 0.001			
ACT7	-0.16 0.11	-0.23 0.05	0.13 0.18	0.02 0.78	-0.11 0.28	0.02 0.81	1.00 0.001		
ACT8	-0.02 0.78	-0.05 0.59	-0.01 0.9	-0.04 0.64	-0.10 0.28	-0.01 0.62	-0.05 0.62	1.00 0.001	
ACT9	-0.09 0.36	-0.17 0.08	0.25 0.01	-0.02 0.78	-0.06 0.50	-0.07 0.49	-0.01 0.88	0.01 0.89	1.00 0.001

TABLE 16 (CON'T)

	ACT1	ACT2	ACT3	ACT4	ACT5	ACT6	ACT7	ACT8	ACT9
ACT10	-0.14 0.17	-0.04 0.69	0.10 0.33	-0.05 0.62	0.025 0.80	0.001 0.99	-0.19 0.06	-0.11 0.25	-0.20 0.05
ACT11	-0.04 0.64	-0.19 0.06	0.28 0.01	-0.02 0.78	0.03 0.74	-0.04 0.69	-0.20 0.04	-0.03 0.76	-0.01 0.90
ACT12	0.10 0.31	-0.25 0.01	-0.01 0.90	0.32 0.001	-0.13 0.18	-0.10 0.31	-0.03 0.75	-0.10 0.30	-0.12 0.23
ACT13	-0.22 0.05	-0.23 0.05	-0.01 0.90	0.12 0.23	0.11 0.24	-0.10 0.28	-0.22 0.02	-0.05 0.58	0.02 0.84
GR1	-0.02 0.78	0.83 0.001	-0.25 0.01	0.003 0.97	-0.04 0.67	-0.29 0.01	-0.16 0.09	-0.07 0.49	-0.14 0.16
GR2	-0.01 0.87	-0.66 0.001	0.35 0.001	0.13 0.19	0.14 0.16	0.25 0.01	0.24 0.01	0.13 0.19	0.25 0.01

TABLE 16 (CON'T)

	ACT10	ACT11	ACT12	ACT13	GR1	GR2
ACT10	1.00 0.001					
ACT11	-0.02 0.77	1.00 0.001				
ACT12	-0.10 0.29	-0.09 0.36	1.00 0.001			
ACT13	0.05 0.56	0.14 0.16	-0.04 0.64	1.00 0.001		
GR1	-0.13 0.19	-0.23 0.05	-0.14 0.16	-0.37 0.001	1.00 0.001	
GR2	0.17 0.07	0.33 0.001	0.17 0.09	0.46 0.001	-0.75 0.001	1.00 0.001

Where; ACT1 - ACT13 are all the coded activities, GR1=group of obligatory activities, GR2=group of discretionary activities.

TABLE 17

Correlational Analysis For All
Demographic Characteristic

	SEX	AGE	STAT	NCHILD	EDUC	HOME	YRESID
SEX	1.00 0.001						
AGE	-0.22 0.05	1.00 0.001					
STAT	0.04 0.66	0.55 0.001	1.00 0.001				
NCHILD	-0.20 0.05	0.71 0.001	0.46 0.001	1.00 0.001			
EDUC	-0.12 0.22	0.39 0.001	0.33 0.001	0.33 0.001	1.00 0.001		
HOME	0.23 0.05	-0.32 0.001	-0.04 0.68	-0.48 0.001	-0.15 0.13	1.00 0.001	
YRESID	-0.25 0.01	0.65 0.001	0.20 0.05	0.47 0.001	0.41 0.001	-0.42 0.001	1.00 0.001

Where; STAT=marital status; NCHILD=number of children;
 EDUC=number of years spent in formal education;
 HOME=type of home; YRESID=years of residence.

DEMOGRAPHICAL DIFFERENCES
AMONG THREE SITES

TABLE 18

Analysis of Variance for Number
of Children in Three Sites

Source of Variance	df	Mean Square	F	P
Between groups	2	19.926	13.88	0.0001
Within groups	93	1.436		
Total	95			

TABLE 19

Analysis of Variance for
Education in Three Sites

Source of Variance	df	Mean Square	F	P
Between groups	2	2.758	3.94	0.02
Within groups	93	0.700		
Total	95			

TABLE 20

Analysis of Variance for
Years of Residency in Three Sites

Source of Variance	df	Mean Square	F	P
Between groups	2	19.413	17.61	0.0001
Within groups	93	1.022		
Total	95			

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THE RELATIONSHIP BETWEEN RESIDENTIAL
DENSITY AND HUMAN ACTIVITY

by

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AN ABSTRACT OF A MASTER'S THESIS

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This thesis was basically concerned with the area of environment behavior interaction. Relationships among hysical components of the environment, perception of the environment, and human behavior (daily activities) were explored. The rationale followed in this thesis draws on the notion that the physical environment plays a part in the lives of people and there is a relationship between the environment and behavior.

With the aid of U.S. census and Manhattan Planning Office data, three sites or neighborhoods in Manhattan, Kansas were chosen to represent different objective densities. A random selection of a universe of 270 people was drawn from the three sites. Only 96 subjects consented to be interviewed. A standardized questionnaire was used to gather the data. The instrument was made of three sections; the first section assessed demographic characteristics, the second section measured perceived density, and the third part assessed daily activities.

The most significant finding from this research was that perception of density is positively related to objective density measures. The variation in perception can be attributed to the conceptual definition of perceived density. The relationship between perceived density and human activities was insignificant. Meanwhile, the activity variables were more related to the demographic characteristics than the objective density.

This research provides a better understanding to the issue of residential density as related to perception and activities. Also, the findings from this research can generate more hypotheses about the objective and perceived density for any researcher who is interested in the same area.